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in the various operations of nature. It is in consequence of such a motion, arising from a certain degree of heat, that the Tourmalin, and the other gems, are rendered strongly electric: and this plainly shews, that a less degree, even that which accompanies them where they are found, may make them also electric; but with the difference of making them less sensibly so. Accordingly, having explained what he means by the word attraction, he says, “ The attraction of
 “ gravity, magnetism, and electricity, reach to very
 “ sensible distances, and so have been observed by
 “ vulgar eyes; and there may be others which reach
 “ to so small distances as hitherto escape observation,
 “ and perhaps electrical attraction may reach to such
 “ small distances, *even without being excited by friction.*”

London,
 December 23, 1764.

LXVIII. *Observations on the Tides in the Straits of Gibraltar; by Henry More, Esq;*

Read Jan. 28,
 1762.

AS every attempt made, whether attended with success or not, towards illustrating what is already known, or drawing from obscurity for want of sufficient observation, or scouring off the rust of error from reality, either through curiosity or order, has always met with the candid countenance of your most honourable Society;

VOL. LII.

M m m

I beg

I beg leave to remind you of what has been suggested, and inculcated, of a (I call it supposed) constant influx of the waters through the strait of Gibraltar to the Mediterranean : with the difficulty occurring, to account how that immense supply, (which some ingenious worthy gentlemen have been at the trouble to calculate) besides what is poured in by many great rivers, can be expended.

Vapour being deemed insufficient far, recourse is had to the notion of an under-current ; an idea to me, at first glance, incompatible with nature, notwithstanding its being founded on an experiment made by a master of a ship, in his passage through the strait, with a fair wind and good way through the water, by lowering a bucket certain number of fathoms deep ; which remarkably abated the ship's way ; from whence I suppose the inference to be drawn.

Now, that such a cause should have such an effect, especially the resistance of the water to be forced through at so great a depth being so great, I take to be obvious. Besides, the ship might have deviated in her steerage from the stream or stripe of water she was in, at the lowering of the bucket, into another counter-stream, which I shall beg leave to offer to your consideration and correction by and by.

Previous to any remark or reflection of mine on the matter, I entreat to be considered absolutely free from any motive whatever, but the hope of doing somewhat more for the public utility, and having the honour of your approbation of the hints arising from my observation.

I made

I made it, during the years I was an officer in that part of the world, (sixteen of which were employed in Gibraltar) part of my application to account, as well as I could, for the difficulty of the navigation of the strait; as also the philosophy of it, with respect to the surplus waters, supposed from the great inlets, and no apparent outlet.

In order to which, the first object presenting itself is the tides; which came necessarily under my notice, from one of the services, besides other duties, I was engaged in; namely, the forming an inundation on the land side of the garrison; the excavation of which being to be carried out, and thrown into the bay, depended almost entirely on the tides, to bring the flat boats near the shore, to receive the earth; which in a manner compelled me to that consideration, on which much depended the execution of the work, which held upwards of four years; during which time, the tides were, in the main, from two to four feet rise, regular as in other places, unless by powerful winds without, I mean from the ocean, or Mediterranean, accelerated or retarded, which would a little vary the rise of water.

That a very strong tide, at the rate of some knots, sets from the strait into and out of Gibraltar bay, from Cabrita and Europa points, is notorious.

That this stream out and in by Europa is, by my estimation, a mile or better wide, I have frequently observed.

At the same time the tide has been pouring into the bay, round Europa, I have remarked, both from the high shore and in boat, another stream in the offing, going the contrary way.

On account of which, vessels knowing this, coming from Malaga, &c. usually, if they find the stream against them under Europa, come to an anchor behind the hill, and wait there for the tide, which will soon bring them in : others not knowing, or neglecting this, have been, by the westerly winds (in this case supposed) and the stream, which they are sure to have against them, either one or the other, hoisted up near Malaga again.

As a farther confirmation of my idea, relating to the mid-stream : being on guard at Europa, in the forenoon, there came a Spanish xebec from the west, with little wind, and in time was becalmed right off a rock I sat on ; where I continued almost the whole day, to observe her, driving back again with a mid-stream, to appearance half-chanel over, and edging outwards towards the Barbary side ; when, about seven in the evening, with little or no wind as before, she returned, at a great rate, and so continued, till night and distance hid her in the Mediterranean.

As to my sentiment, and what has given a strong bias thereto, with regard to the two side-streams, viz. the tide on the Spanish side, and the tide on the Barbary shore, I must beg your patience to another observation.

Setting sail with a light Levant, to pass the strait to the westward, the ship I was in met a strong tide turning Cabrita point, which all the sail we could spread was but barely enough to stem ; keeping, however, the Spanish shore, whilst others, near seventy, stood off for the middle, in an hour, or little more, the tide turned, and we made our way at a tolerable rate, till we were passed Tariffa, almost
opposite

opposite Tangier, when the wind became unfavourable, and we, by stretching across, found the Barbary tide for us, which carried us out clear of the capes; when the whole fleet, except three, were put back to Gibraltar, and lay there three weeks for another wind: the whole dependence of navigators being a strong Levant wind to push them through, without reckoning about current.

How greatly the contrary being attended to would benefit commerce, more need not be told, than that two ships lying in Gibraltar bay, bound to London; one, by getting a small start of the other, made her passage, came back, and found her companion still waiting in the bay.

That this was owing to the first having knowledge of the different streams, I don't say, but to his alertness in catching the first of the Levant, whilst the other staid to finish his bowl, and pay his reckoning.

But had he been tolerably acquainted with the streams, I don't yet see, why he might not have got through, as well as we.

Permit me to give one observation farther; which, though it doth not reach the whole length of the gut, it does in part, viz. the barks, &c. passing from Ceuta to Spain, every day shewed us, with what facility, in the last war, the Spaniards would run across the strait, and fetch near Tariffa, or, at worst, a bay between it and Cabrita; when 'twas as plain, that the self-same barcalonga, or xebeck, when taken, after that English were put on board, could do nothing like it.

Whence my inference is, the Spaniard timed the tide, the English, not.

I now

I now beg permission to point out my thoughts respecting the Barbary side of the strait, and the tide along it: to illustrate which, I must tell likewise what happened to myself, returning from the westward to Gibraltar. When the ship I was on board of was off Tangier, about five in the evening, we were joined by another, with whom we conversed a small time; then each took the way he chose, to get to Gibraltar, it being a light Levant, consequently against us, and both ships near mid-channel.

The ship, that spoke with us, stood on her tack to the Spanish side, where she must, I think, fall into the tide along that shore; by the aid of which, she got to anchor in Gibraltar bay, that night, before ten.

We, on the contrary, from a conceit the master had, that he was most lucky on that side, stood on the Barbary tack; the stream on which side, notwithstanding our labouring and turning to windward, by next morning had hoisted us far out into the ocean; next day we got into the strait, and drove out again; the same the second and third, by crossing the different streams alternately: so that it took us four days to do what the other did in four hours.

That the Spaniards are not masters of the different set of the tides, other than what has been said about Ceuta, I believe; for these reasons, viz. their commerce from Cadiz is generally carried on in small barks along shore, round cape Trafalgar to Tariffa, Algazira, and Ceuta on the other side; in which navigation, they consult only what I, for distinction's sake, call Spanish tide, coming to as often as it shifts against them; without being much solicitous about
the

the mid-stream, or at all about the Barbary tide, which they dare not approach, on account of the perpetual war between those two people, so as to acquire the knowledge we want; neither are we to think of such civility from them.

From the hints and remarks I have made, why may not the tides in this strait be somewhat analagous to the different tides daily observed between Portsmouth and the Isle of Wight, called there tide and half-tide? which is, if I remember right, described to be thus :

That when it is high-water in the mid-chanel, 'tis half-ebb on one side, and low-water on the other, (or else, when high-water on one shore, 'tis half-ebb in the midst, and low-water on the other) and so vice versa change alternately.

Whether this theory carries with it any valuable degree of reality or not, I hope a proper time will come, when it may be ascertained, by employing fit persons for that purpose.

If on survey it should turn out, what I hope, viz. that such tides there are, and that, by understanding the set and times of these (as yet supposed) streams, a vessel be enabled to work *in* or *out* of the strait, with a contrary or light wind, 'tis enough.

Should it succeed, I am highly happy in moving it; should it not, I am happy still, from the well-meaning.